

Implementation of the Level-0 Low Multiplicity Topology Trigger for STAR

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In 2001, a low-multiplicity topology trigger was implemented at STAR to investigate exclusive ρ production in ultra-peripheral heavy-ion collisions, $AuAu \rightarrow AuAu\rho^0$.

This process has a specific experimental signature rather different from a typical high multiplicity hadronic ion-ion collision: the $\pi^+\pi^-$ decay products of the ρ^0 are observed in an otherwise empty spectrometer. The pion tracks are back-to-back in the transverse plane since the ρ^0 are produced at low transverse momenta. The two gold nuclei remain in their ground state. Therefore, the zero degree calorimeters can not be used as a trigger.

For the topology trigger, the central trigger barrel (CTB) was divided into 16 $\Delta\eta\Delta\phi = 0.5 \times \pi/2$ pixels: 4 rings (East to West) of quadrants: North, South, Top, and Bottom. Each pixel consists of 15 scintillator slats read out by one data storage and manipulation board (DSM).

A DSM consists mainly of a programmable logic unit. Fig. 1 shows the three layers of the CTB DSM tree. The first layer converts the ADC counts per slat into a minimum ionizing particle (MIP) equivalent using input look-up tables. A time stamp is used to reject events with out of time hits. For the central trigger the MIP counts of all CTB slats are summed through the DSM tree. In addition, the second layer sets thresholds on the minimum and maximum number of hit slats and MIP counts (typically between 1-3) per pixel. The third layer combines patches with a valid number of hits to a North-South requirement. A top and bottom veto was used to suppress cosmic rays. High multiplicity events are rejected by an overflow veto. A fast on-line reconstruction –level 3 trigger– eliminated events with more than 15 tracks or with-

out a reconstructed vertex.

The present implementation of the topology trigger in the DSM tree allows it to run it in parallel to the trigger for central collisions, thus to use-up available DAQ bandwidth. The level-0 rate was 20-40 Hz (about twice the central collision rate), of which 1-2 Hz passed the on-line reconstruction. With this trigger, 1.55 M. events were collected in 2001. The total 2001 data set contains $\sim 25,000$ ρ events, about 50 times the previously available statistics.

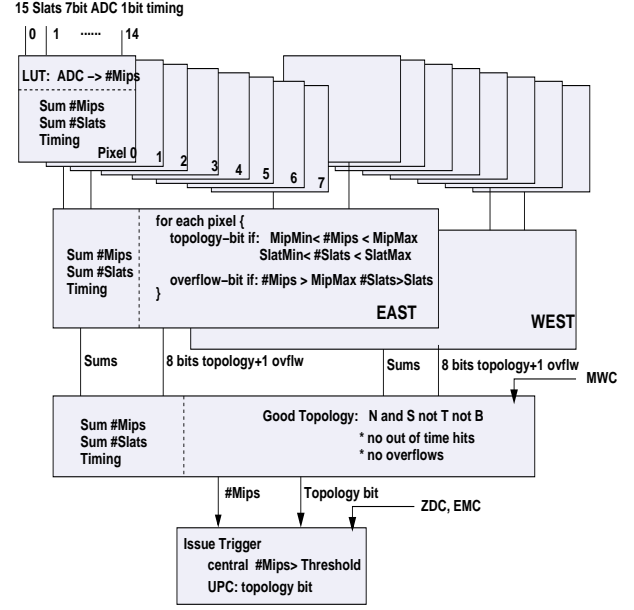


Figure 1: Lay out of the level-0 CTB DSM tree and the topology trigger

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